that is, the values of a policy by one Table will be greater or less than by another Table according as the values of the annuities-due decrease in a greater or less ratio.

If $\frac{1+a'_{x+n}}{1+a'_x}$ be greater than $\frac{1+a_{x+n}}{1+a_x}$, then $\frac{a'_{x+n}}{a'_x}$ will generally be greater than $\frac{a_{x+n}}{a_x}$, and we might safely say that a Table, whose annuity values decrease in a greater ratio than those by another Table, will give the greater policy values. From this it might reasonably be inferred that a Table in which the mortality *increases at a greater rate* than represented by another Table would give the larger value for a policy, even though the latter Table might exhibit a greater mortality. In order to see whether this really would be the case, I formed two hypothetical Tables of Mortality by taking the Carlisle premiums, and in one case adding a constant quantity throughout, and in the other case increasing them by 25 per cent; and then working out the rate of mortality by an inverse process. I thus obtained two Tables, each with a higher mortality throughout than the "Carlisle"; while at the same time one Table would give a smaller, and the other a larger Policy value throughout. The result was very unfavourable to the theory; for while the rate of mortality throughout the first hypothetical table increased at a slower rate than in the Carlisle table; in the second, instead of increasing at a greater rate, the ratio was generally below that in the original Table, and, towards the end, even fell below the other hypothetical Table. So that, although it may generally be the case that a Table, in which the mortality increases at a greater rate than in another Table, will give a greater Policy Value, yet it will not always be so; and, therefore, can be no criterion to go upon. Nor are there any means, so far as I can at present see, of ascertaining, with certainty, what influence the rate of mortality has upon the value of a Policy.

Conditions of the Messenger Prize (1868) (*above referred to*).

INSTITUTE OF ACTUARIES
OF
GREAT BRITAIN AND IRELAND.

The Council of the Institute of Actuaries have resolved again to offer a Prize of the value of Ten Guineas for the best Essay to

be written by a Member of the Institute who has passed his Second (or Third) Year's Examination, and is not an advertised officer of any Insurance Company. The Prize will be given in the form of books, to be selected by the successful competitor from works relating to Mathematical, Statistical, or Economical Science.

The subject proposed on the present occasion is as follows:

"A Comparison of the Values of Policies as found by means
" of the various Tables of Mortality and the different
" methods of Valuation in use among Actuaries."

In the treatment of this subject, it is desired that the competitors should—

(1) Enumerate the various tables of mortality, and give references to the works containing the original data on which each is founded.

(2) Describe the different methods of valuation now employed, so far as known

(3) Give examples in a tabular form of the values of policies taken out at various ages, and continued in force for various terms, as found from each table of mortality, each rate of interest, and by each method of valuation.

(4) Consider to what extent the employment of any particular data or method may affect the reserve made by a Life Office for its liabilities. Under this head it is desired that examples should be given corresponding as nearly as may be to the conditions which are found to prevail in practice.

(5) Give illustrations of the manner in which the divisible surplus, present and future, will be influenced by the same circumstances.

(6) Examine in what manner the rate of mortality influences the value of the policy; showing in what cases a mortality table with a high rate of mortality gives a larger value, and in what cases a smaller value, than another table in which the rate of mortality is lower.

CONDITIONS OF THE COMPETITION.

1. That the Essays shall be sent in to the President of the Institute on or before the 1st of January next.

2. That the names of the competitors shall be sent in under seal, with a Motto corresponding to one to be affixed to the head of the Essay, such Motto and Essay not to be in the handwriting of the competitor.

3. The Essay for which a prize shall be awarded to become the property of the Institute.

4. The unsuccessful Essays to be returned with the corresponding envelopes unopened.

5. No prize shall be awarded unless the adjudicators shall consider some Essay worthy of the distinction.

By Order of the Council,

ARTHUR H. BAILEY,
ARCHIBALD DAY,
Honorary Secretaries.

12, St. James's Square, S.W.
1*st June*, 1867.

On the Construction of Tables by the Method of Differences. By Peter Gray, F.R.A.S., *Honorary Member of the Institute of Actuaries.*

Section IV.—*On the Construction of Tables in which the Characteristic Function is Irrational.*

(118). Irrational Functions, strictly speaking, are functions whose numerical values cannot be expressed by finite fractions. In the present connexion the term irrational has a wider signification. It is used to denote any function whose numerical value cannot, in general, be expressed *exactly* within the limits as to decimal places, to which we restrict ourselves in the table under formation. As here employed therefore the term designates not only transcendental functions, (as exponential, logarithmic, circular, &c.,) and algebraical irrational functions, (which are such as contain fractional powers of the variable in either numerator or denominator, or both,) but also algebraical fractional functions, which are such as contain integer powers of the variable in both numerator and denominator, or in the latter only. And it is to the formation of tables of the values of functions such as these that our attention is now to be directed.

(119). The characteristic of irrational functions which renders necessary a different mode of treatment from that which we found so efficient when the functions dealt with were rational, is that those functions have no constant differences. It was shown (60) that in a rational function of the nth degree the nth difference is